Space Weather Technical Forecast

Issued on Saturday, 18 June 2022 at 13:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Daily chance of an isolated M-class flare. Active (1e8 integrated pfu) fluence becoming likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low with a decreasing number of C-class flares, mostly originating from AR3030 and AR3031. There are currently nine numbered sunspot regions plus a new regions on the visible disc. The largest and most complex is AR3030 in the northwest, with some minor activity observed in the intermediate spots. There are three active regions, on the western hemisphere, that are relatively large, AR3031, AR3032 and AR3038 but showing little change and the remaining regions are mostly simple with little or decreasing growth observed in recent hours. No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, is indicative of a coronal hole high speed stream, although the source is a little uncertain. Solar winds have recently been around 600 km/s with a peak observed at 17/1405UTC of 698 km/s. Density was near o slightly above average levels. The IMF, Bt, was weak at 7nT or below, while the north-south component, Bz, fluctuated between +7/-6nT. The phi angle was predominantly positive (away from the Sun), with some brief negative variations. Geomagnetic activity was Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: Electron flux (greater than 2MeV) was at moderate levels and just below the High alert threshold for a good part of the period and reached 937 pfu at 17/1800 UTC. Corresponding 24-hour integrated electron fluence continues on a rising trend, with a value of 2.7e7 integrated pfu at 18/0000UTC. The high energy proton flux (10 MeV) measured by GOES16 was at background levels.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low with a daily chance of an isolated M-class flare, and a slight chance of an X-class flare.

Solar Wind / Geomagnetic Activity: No CMEs are currently expected to affect Earth during the period. Solar winds are anticipated to remain elevated, perhaps occasionally strong over the next two to three days, due to coronal hole influences. Solar winds then probably declining from Day 3 into Day 4 (20-21 June). Quiet to Unsettled geomagnetic activity continuing ,with a chance of an Active or even a slight chance of a G1/Minor Storm interval on Day 1 (18 June). Geomagnetic activity becoming largely Quiet through Day 3 into Day 4 20-21 June).

Energetic Particles / Solar Radiation: High energy electron flux (greater than 2 MeV) is currently at background to moderate levels, and will probably reach High (1000 pfu) levels during diurnal peaks over the coming days. Electron fluence is also likely to follow a rising trend, with Active (1e8 integrated pfu) levels probable during the period. High energy proton flux (greater

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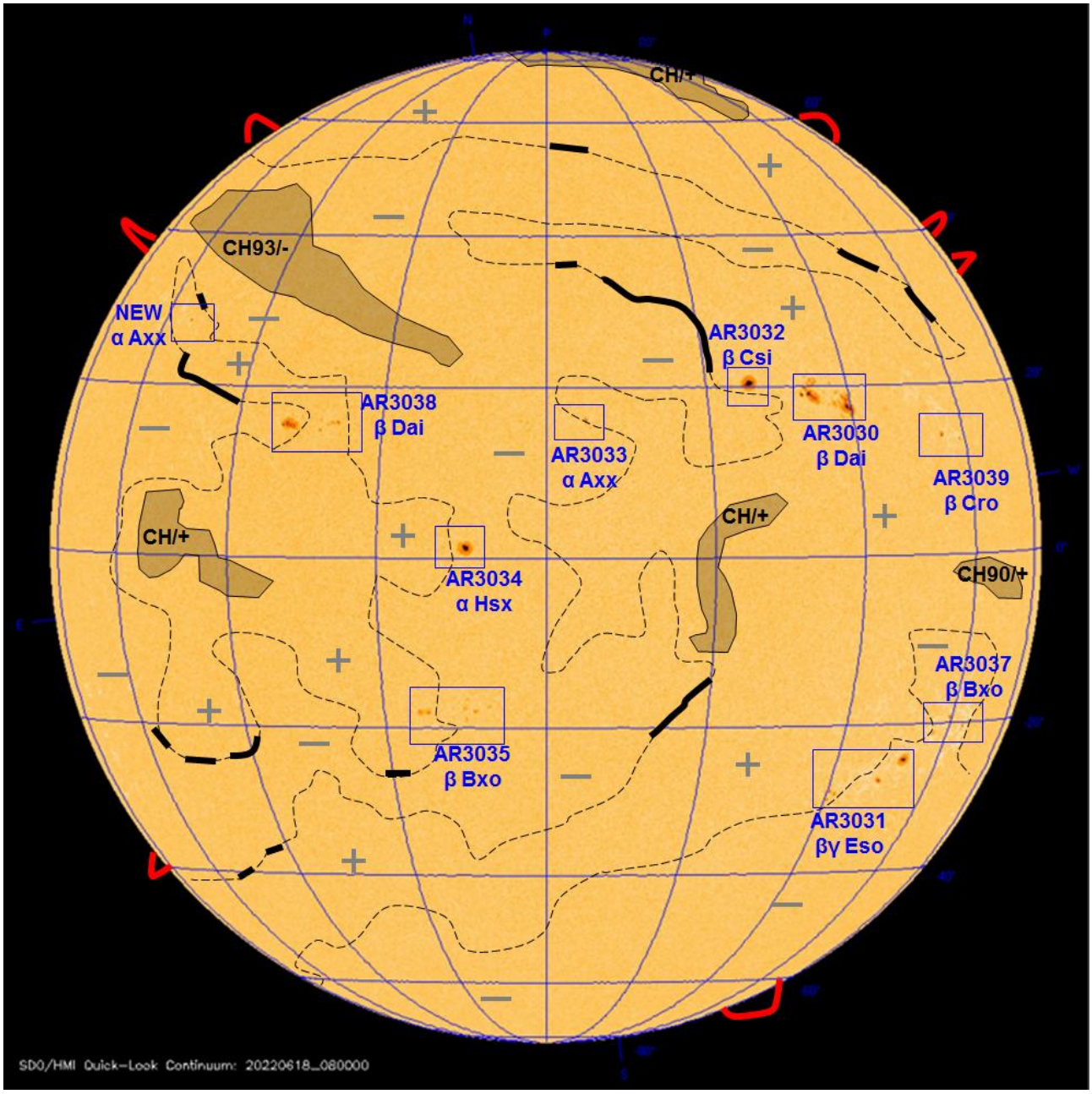
than 10 MeV) is expected to be at background levels during the period, with a slight chance of an S1 or greater event occurring.

Figure 1. Solar Analysis Valid 0800 UTC, 18 June 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

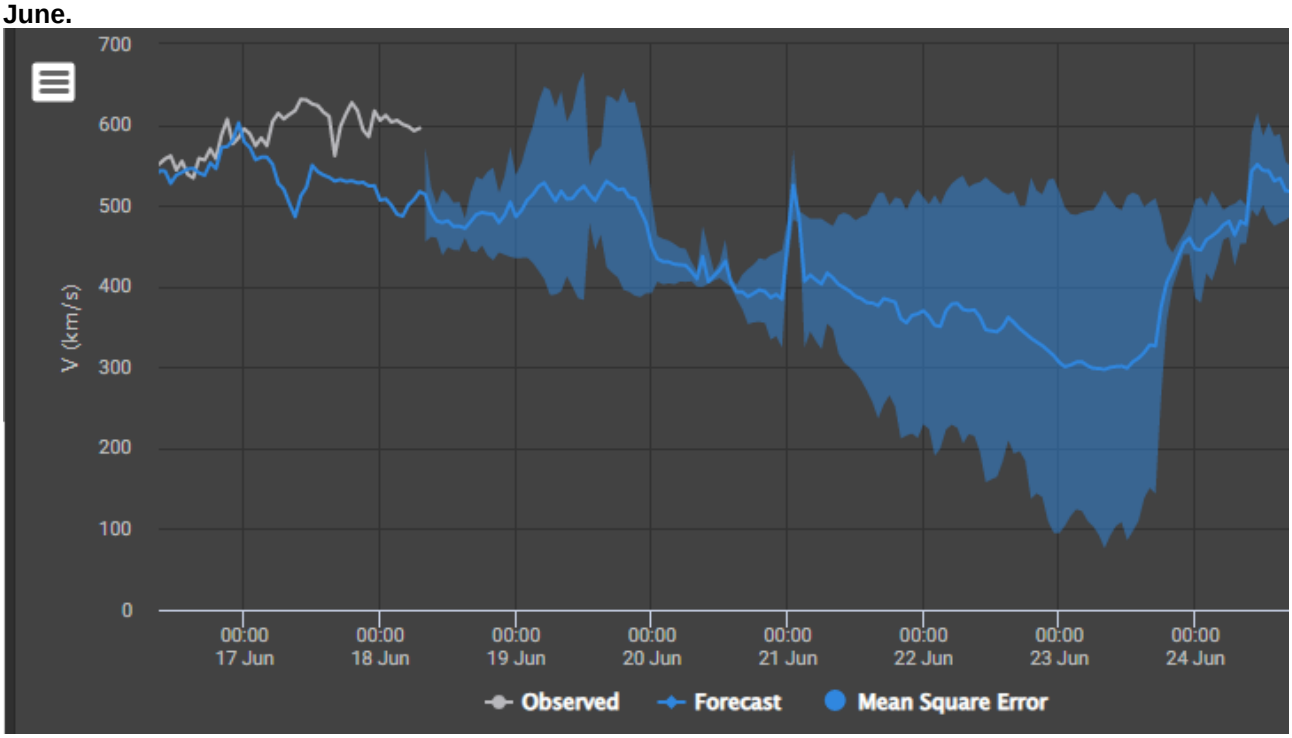
No CMEs are currently expected to affect Earth during the period.
Solar wind speeds are likely to remain largely elevated or perhaps strong over the next two to three days, under the influence of 2 or three coronal holes before then declining from Day 3 into Day 4 (20-21 June) as these features rotate away from a geoeffective position. Quiet to Unsettled geomagnetic activity with a chance of an Active interval or a slight chance of a G1/Minor Storm on Day 1 (18 June), should there be any prolonged period of negative Bz. Geomagnetic activity becoming largely Quiet through Day 3 into Day 4 (20-21 June).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office Solar Winds Prediction Model (SWPM), indicating a plausible decline from 20 June.



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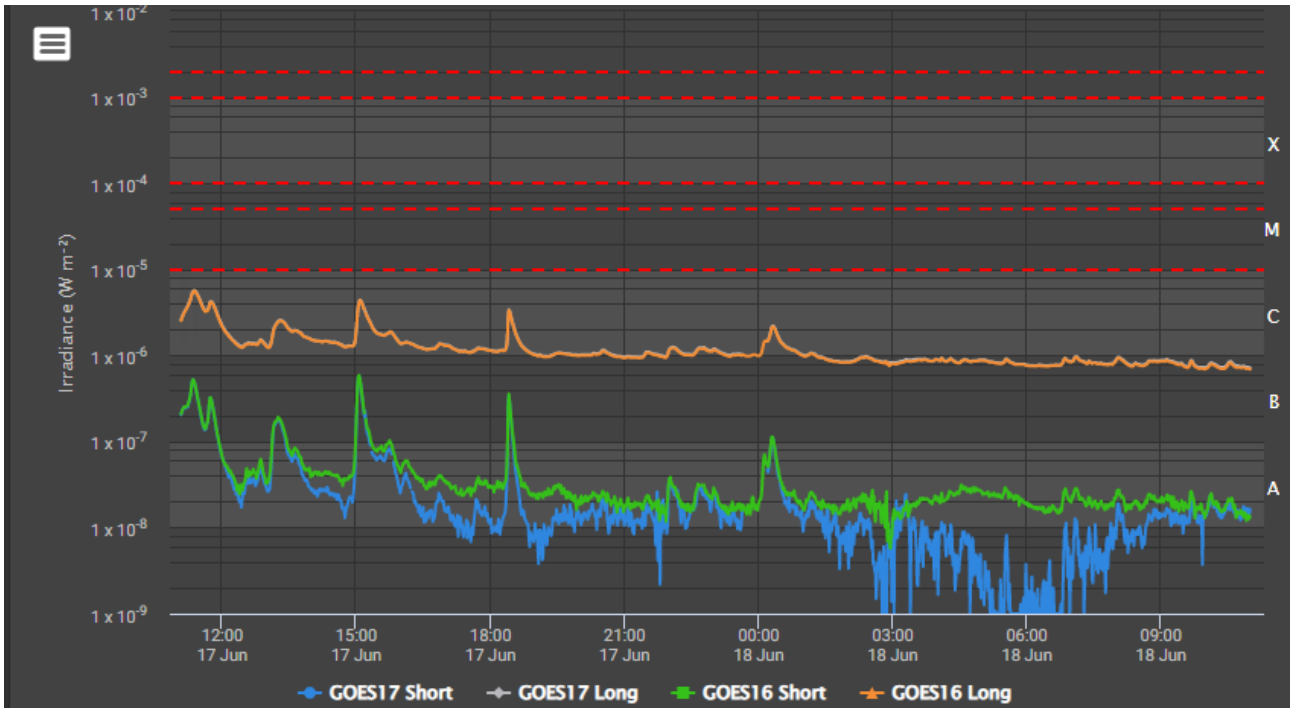
Radio Blackouts - X-Ray Flares:
There are currently nine numbered sunspot regions and one new region on the visible disc. AR3030 (Dai/Beta) in the northwest is currently the largest group and there is some retrogressing motion being displayed with the intermediate spots. AR3031 (Eso/Beta-gamma in the southwest quadrant and both AR3032 (Csi/Beta) and AR3038 (Dai/Beta) in the northwest quadrant have shown little change in recent hours. All other spot groups are either unchanged in overall appearance, or showing some minor decay, and have relatively simple uni-polar or bi-polar magnetic configurations.
Despite the congested disc, X-ray flare activity has become increasingly limited, with only a few C-class flares, mainly from AR3030 and AR3031. Some brighter flux from over the east limb is currently visible on STEREO-A imagery, although it is currently unclear if this is likely to be from further sunspot regions or just areas of plage. Overall, further C-class flares are expected with a chance of isolated M-class flares, and a slight chance of an X-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: X-ray flare flux with a decrease in the number of C-class flares over recent hours.



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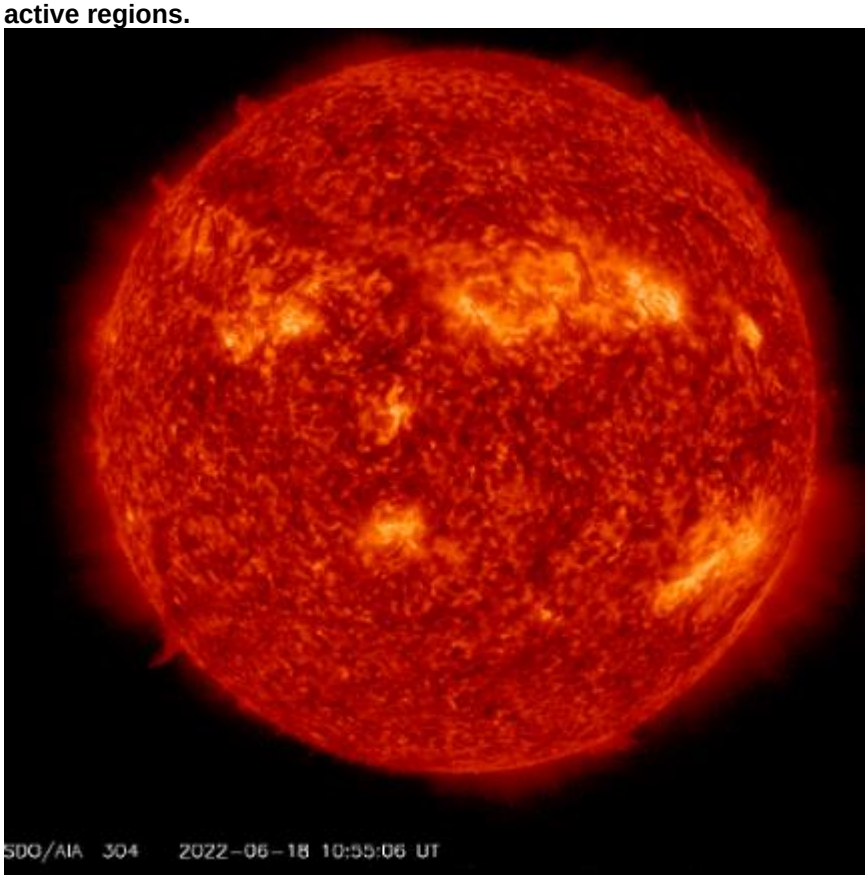
Solar Radiation Storms - (High Energy Protons):

There is a slight chance of an S1 or greater event in the period, as a result of the westward transit of the four largest sunspot regions, which are the most likely of the current cohort to produce a significant flare and are now at increasingly favourable longitudes to give a proton enhancement at Earth.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: SDO-aia 304 imagery at 1055UUTC, 18 June 2022, giving an indication of the location of active regions.



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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) as observed by GOES-16 is at normal background to Moderate levels, having peaked just shy of the High (1000 pfu) alert threshold. A further rising trend is expected in the coming few days given the current elevated to strong solar winds, with these expected to continue through the next 2 to 3 days. Flux is likely to peak at High levels during the periods of diurnal maximum.
The corresponding electron fluence is expected to follow a rising trend, with exceedance of the Active (1e8 integrated pfu) threshold becoming likely during the period. The upward trend from MOSWOC REFM output is giving reasonable guidance, although the peak values on Days 2 and 3 (19-20 June) appear to be a significant overestimate, with a peak value near or just above Active more likely.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	30	40	50	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux at GEO and Met Office REFM output with a rising trend in evidence.

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